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A Report for the Wild Salmon Center

Pebble Mine Final Environmental Impact Statement (FEIS): Anticipated Adverse Impacts to Wetlands

By Matthew Schweisberg, PWS[1]

EXECUTIVE SUMMARY

The Pebble Limited Partnership (PLP) is proposing to develop the Pebble copper-gold-molybdenum porphyry deposit, located in the headwaters of Bristol Bay, southwest Alaska.

- **According to the FEIS (Chapter 4, Table 4.22-40), proposed mining operations for the base project would have at least the following adverse impacts to wetlands and stream:**
  - **Direct impacts to wetlands: 2,231 acres**
  - **Indirect impacts to wetlands: 1,609 acres**
  - **Direct impact to streams: 105.4 miles**
  - **Indirect impacts to streams: 79.5 miles**
  - **Temporary impacts to wetlands: 773 acres**
  - **Temporary impacts to streams: 6.2 miles**

- **The expansion project would have at least the following adverse impacts to wetlands and streams:**
  - **Direct impacts to wetlands: 8,756 acres**
  - **Direct impacts to streams: 330.5 miles**
  - **Indirect impacts to wetlands: 1829 acres**
  - **Indirect impacts to streams: 17 miles**
  - **Temp impacts to wetlands and streams: 0**

- **Cumulatively, adverse impact totals would be at least the following:**
  - **Cumulative direct impact to wetlands: 10, 987 acres**
  - **Cumulative direct impact to streams: 435.9 miles**
  - **Cumulative indirect impact to wetlands: 3,438 acres**
  - **Cumulative indirect impact to streams: 96.5 miles**
  - **Cumulative temporary impacts to wetlands: 773 acres**

[1] Principal, Wetland Strategies and Solutions, LLC. I am a federal (retired) wetlands ecologist and wildlife biologist. I work throughout the U.S. A private consultant for the last 8 years, I spent nearly 33 years with the U.S. EPA at both its Headquarters office and New England Region office in Boston, MA. Prior to retiring from federal service, and among other roles, I served concurrently as Chief of the New England Region's Wetlands Protection Program. During my entire tenure with EPA's New England Region, I also served as the Region's Senior Wetlands Ecologist. I have extensive experience with coastal and inland wetlands and other aquatic resource issues for major projects involving transportation, energy, agriculture, commercial and port development, and hazardous waste cleanup. I am a nationally recognized expert in the federal Clean Water Act's Section 404 Program. I also testified before federal grand juries and served several times as an expert witness on wetland regulatory and technical matters at both federal and state levels.

Based on my review of the FEIS, record evidence, and my expertise, here are my key findings:

- **The FEIS lacks substantive, accurate, and detailed information regarding the extent, magnitude, and permanence of the adverse effects to wetland and other aquatic resources that would occur from the Pebble Project, resulting in a wholesale underestimation of the types and significance of those adverse impacts.** The FEIS does not provide meaningful, accurate, or detailed information necessary to clearly and fully describe the adverse effects of the proposed mine and its associated components. The FEIS's attempt at describing and quantifying the amount and extent of adverse impacts to wetlands and streams falls incredibly short. Even accepting the underestimated numbers of impacted wetlands and streams provided in the FEIS, the Pebble Project would have an immense, unprecedented, and uncompensable impact on the Bristol Bay watershed.

- **The FEIS fails to identify, describe, and evaluate the specific ecological functions and values of wetlands and aquatic resources that would be destroyed or degraded by the Pebble Project, further underestimating the project's impacts.** Despite revisions and additional information included in the FEIS—which now includes the preferred alternative of the Northern Transportation Corridor—the project still would cause devastating adverse impacts to wetlands and other water resources within the Bristol Bay watershed.

- **The proposed compensatory mitigation plan described in section 5.3.2 of the FEIS is farcical. The proposed compensatory measures bear no relationship to the magnitude and extent of significant harm that would occur to the affected wetlands and other aquatic resources in the Bristol Bay watershed.** Even more absurd is that PLP states that it "is not proposing compensatory mitigation for the project's temporary impacts, because those WOUS and functions would be expected to recover in the short-term after restoration." The construction phase of this project would take at least 4 years, so many temporary impacts would last at least that long. Many of the lost and degraded ecological functions would likely take several more years, if not longer, to recover.

- **The information in the FEIS does not alter my opinion in my previous DEIS report: were this project to receive a Clean Water Act section 404 permit from the Army Corps of Engineers, it would be among the largest, if not *the* largest, and the most damaging project ever authorized under the Clean Water Act.**

- **The proposed project cannot be permitted under Section 404 of the CWA for two principal reasons.**

    1. There does not exist sufficient information to make a reasonable judgment as to whether the proposed discharges can comply with the Section 404(b)(1) Guidelines (40 CFR Part 230.10 (a)-(d)). See 40 CFR Part 230.12(a)(3)(iv). Throughout this report, I highlight that paucity of sufficient information.

    2. Notwithstanding that information deficit, based on the available information I reviewed, the project would clearly cause or contribute to significant degradation of the affected aquatic resources, in violation of Section 230.10(c) of the Guidelines.

1. Introduction

To prepare this report, I reviewed the —

- FEIS;
- DEIS and my report (May 14, 2019) on the Draft;
- reports of other Pebble Team experts, e.g.,
    - Thomas Yocom;
    - Siobhan Fennessy;
    - David Chambers;
    - Gordie Reeves;
    - Sarah O'Neal;
    - Cameron Wobus;
    - Susan Lubetkin; and,
- multitude of reports, documents, comments, and email messages from state and federal agencies, tribes, and NGOs, that exist in the record for this proposed mine project (see https://pebbleprojecteis.com).

This report updates portions of and expands upon my previous report on the DEIS and should be considered in conjunction with that earlier report. This report further addresses the direct, indirect (secondary), and cumulative adverse environmental impacts to wetlands and aquatic resources that would occur from the proposed Pebble Mine project, including its associated components.

The FEIS addresses issues raised in my previous report only partially or not at all. These issues include —

- deficiencies with the identification of wetland resources;
- identifying and describing all relevant wetland ecological functions; and,
- identifying and evaluating direct, indirect (secondary), and cumulative adverse impacts.

2. Site Setting and Ecology[2]

The Bristol Bay watershed is a largely undisturbed region with outstanding natural, cultural, and mineral resources. The Pebble deposit is in the headwaters of tributaries to the Nushagak and Kvichak Rivers. The Nushagak and Kvichak Rivers are the largest of the Bristol Bay watershed's six major river basins, containing about 50% of the total watershed area. The watersheds of three tributaries to these rivers originate within the potential footprint of the proposed mine on the Pebble deposit: the South Fork Koktuli (SFK) River, which drains the Pebble deposit area and

[2] For a more complete description of the environmental setting and aquatic resources within the Bristol Bay watershed, see Section 3, *Proposed Determination* ("the PD") *of the U.S. Environmental Protection Agency Region 10 Pursuant to Section 404(c) of the Clean Water Act Pebble Deposit Area, Southwest Alaska,* EPA, July 2014; and Chapter 3, *An Assessment of Potential Mining Impacts on Salmon Ecosystems of Bristol Bay, Alaska, Volume 1,* EPA, January 2014 ("the Bristol Bay Assessment" or "BBA").

converges with the North Fork west of the Pebble deposit; the North Fork Koktuli (NFK) River, located to the northwest of the Pebble deposit, which flows into the Nushagak River via the Koktuli and Mulchatna Rivers; and Upper Talarik Creek (UTC), which drains the eastern portion of the Pebble deposit and flows into the Kvichak River via Iliamna Lake, the largest undeveloped lake in the United States. The watershed is nearly roadless and pristine, a fact that cannot be over-emphasized.

The Nushagak and Kvichak River watersheds comprise five distinct physiographic divisions (PD, July 2014, Section 3): the Ahklun Mountains, the Southern Alaska Range, the Aleutian Range, the Nushagak–Big River Hills, and the Nushagak–Bristol Bay Lowland. Precipitation is greatest in the Southern Alaska Range, the Aleutian Range, and the Ahklun Mountains, and these physiographic divisions serve as major water source areas for lower portions of the watersheds. Annual water balance, especially in the mountains and hills, is dominated by snowpack accumulation and subsequent melt, although late summer and fall rains are also important contributors to the hydrologic cycle, particularly in the Nushagak–Bristol Bay Lowland division.

The Bristol Bay watershed in general, and the SFK, NFK, and UTC watersheds specifically, provide diverse, high-quality habitat for salmon and other fishes. The waters of Bristol Bay contain locally adapted and genetically distinct populations of salmon that help ensure the long-term health and stability of salmon stocks across the watershed. In particular, the state of Alaska found that the sockeye salmon in the Koktuli River represent a genetically distinct population of river-type salmon that is evolutionarily important and distinctly unique within the Bristol Bay watershed and Alaska.[3] Suitable substrates for salmon spawning, egg incubation, and rearing are abundant. Extensive connectivity between groundwater and surface waters creates and maintains diverse streamflow and thermal regimes across the region, resulting in favorable spawning and rearing habitats for salmonids and helping to support diverse fish assemblages (PD, July 2014, Section 3).

Within the Bristol Bay watershed, freshwater habitats range from headwater streams to braided rivers, small ponds to large lakes, side channels to off-channel alcoves. These watersheds contain over 54,000 km of streams which, due to the limits of mapping accuracy, likely underestimates their extent. The importance of Bristol Bay's extraordinary salmon resource extends far beyond local communities. Bristol Bay is a sought-after destination for sport anglers around the world, who are drawn to the Kvichak River, Nushagak River, Upper Talarik Creek and other legendary Bristol Bay waterways by the world's largest sockeye salmon run and extraordinarily large and powerful rainbow trout. The waters of Bristol Bay support the most valuable commercial sockeye salmon fishery in the world, supplying nearly half of the world's wild sockeye salmon

[3] EPA Region 10 letter, May 28, 2020.

catch. Salmon is also by far the most valuable commercial fish managed by the State of Alaska, and Bristol Bay is Alaska's richest commercial fishery.[4]

Headwater streams and wetlands play a vital role in maintaining diverse, abundant fish and wildlife populations—both by providing high-quality habitat themselves and by supplying energy and other resources needed to support fish and wildlife in connected downstream habitats. Headwater streams and wetlands are abundant in the Pebble deposit area and likely play a crucial role in supporting local and downstream fish populations (PD, July 2014).

3. Major Deficiencies with Wetland Identification

As described more fully by Yocom (2020)[5], the identification and delineation of wetland resources in the study area rely upon the outdated observations and methodologies of the first and flawed preliminary jurisdictional determination (PJD). Even though PLP and the Corps claim that the 2018 field data are sufficiently thorough and cover the varied landscape positions and underlying soil associations to allow using the same aerial photography to distinguish uplands from wetlands within all of its vegetation community mosaics, there is no evidence that PLP or the Corps did any actual on-the-ground field verification of the wetland/upland boundaries within any of the former mosaic areas that it now claims are 100% upland.

Under the initial PJD, the project's adverse impacts to wetland and aquatic areas (as disclosed in the DEIS) were at least 3,560 acres of direct impacts and 2,345 acres of indirect impacts. Under the current PJD, the impacts disclosed in the FEIS have declined miraculously to 2,231 acres of direct impacts and 1,609 acres of indirect impacts. Despite the fact that the project footprint depicted in the FEIS has increased, the total of adverse impacts to wetlands has decreased by an astonishing 2,065 acres, or more than one-third. While there is no defensible explanation in the FEIS for this result, it may be due to the apparent redrawing of overall project boundaries that reduced the analysis area and consequently the area analyzed for project impacts. Such apparent slight-of-hand raises serious questions about the reliability of the information as well as disclosure issues under NEPA for the FEIS.

In addition, there is no clear indication that the entire alignment of the newly preferred Northern Transportation Corridor route was ever walked to identify and delineate wetland resources. These data gaps mean that the FEIS contains inaccurate and unreliable information and that all conclusions based on the amount of delineated wetlands are called into question. Similarly, it follows that the estimated amount of adverse impacts as stated in the FEIS are likely inaccurate and far too low. Reaching such estimates and conclusions based on such considerable data gaps is not sound science.

[4] BBNC comments on the CWA 404 Permit Application for the Proposed Pebble Mine Project (POA-2017-271) and the corresponding NEPA DEIS; July 1, 2019

[5] Thomas G. Yocom, Senior Wetlands Regulatory Scientist, Huffman-Broadway Group, Inc.

4. Fish and Wildlife Resources

The Bristol Bay watershed is undisturbed by significant human development and impacts. It is located in one of the last remaining virtually roadless areas in the United States (BBA, January 2014, Chapter 6). Large-scale, human-caused modification of the landscape is absent, and development in the watershed consists of only a small number of towns, villages, and roads. The Bristol Bay watershed also encompasses Iliamna Lake, the largest undeveloped lake in the United States.

The Bristol Bay watershed provides habitat for numerous animal species, including at least 29 fish species[6], more than 40 terrestrial mammal species, and more than 190 bird species. Many of these species are essential to the structure and function of the region's ecosystems and current economies. The Bristol Bay watershed supports several wilderness compatible and sustainable economic sectors, such as commercial, sport, and subsistence fishing; sport and subsistence hunting; and non-consumptive recreation (BBA, January 2014, Chapter 5).

a. Birds

Section 3.23 (Wildlife Values) of FEIS provides a description of the birds, and the terrestrial and marine mammals that are known, and have a potential to occur, in the project area. This section (3.23.1.1) mentions that "[a]vian surveys for the mine site were conducted primarily from 2004 through 2005 (with a few surveys in 2006) …" In addition, "[h]abitat mapping and habitat-value assessments were conducted across the mine survey area in 2004 and 2005 in an effort to better understand the biological conditions present and how they relate to avian abundance and distribution." As a result, the information reported in the FEIS is at least 15 years old, making it substantially out-of-date, and likely unreliable.

b. Mammals

According to the FEIS (3.23-14), the most recent terrestrial mammal surveys, including for caribou, moose, wolf, and bear[7] were done in 2010 or before, making that data at least 10 years old and out-of-date as well. Much of the mammal data are substantially older and unreliable.

In commenting on the Southern Transportation Corridor described in the FEIS, the Alaska Department of Fish and Game (ADF&G) stated that,

[6] BBA, January 2014, page ES-5

[7] The Southern Transportation Corridor between Kokhanok and Cook Inlet was surveyed for brown bear by helicopter in 2018. See ABR draft report, December 2018. No survey is reported for the Northern Transportation Corridor.

> … the PFEIS analysis of traffic levels recognizes that there will be impacts to bear behavior from vehicle traffic at the proposed 35 round trips per day (70 truck passings/day). This is based on a simple division of 70 truck passings over a 24 hour period to get an average of 1 truck every 21 minutes. It further recognizes that this 70 vehicles / day is already in the upper end of moderate avoidance in the case of bear avoidance and will result in avoidance of the road and surrounding area which will impact denning, bear movements through the area, foraging, etc. However, the PFEIS also documents that there will be additional small vehicle traffic from mine construction and operations as well as local and business traffic that will be permitted. The PFEIS does not include these additional vehicles in the analysis of impacts to bear or other wildlife disturbance and behavior. It is most likely that these additional vehicles will push the level of disturbance and avoidance up into the strongly avoided level. [In addition] the analysis also does not consider the level of disturbance from the proposed large double trailered trucks.

The FEIS shows that brown bear use of the Southern Transportation Corridor is high. These anticipated disturbances create the potential for significant behavioral and habitat fragmentation impacts not just to bear but also to moose and caribou. Surprisingly, the FEIS analysis does not include the additional mine related and local vehicular trips that are proposed for daily use.

PLP recently revised its plans and indicated that it will use the Northern Transportation Corridor that goes from the mine site past Pedro Bay, Pile Bay, down to Williamsport and Diamond Point Port. Although 11 years old, the *Preliminary Final Report on Monitoring the Brown Bear Population Affected by Development Associated with the Proposed Pebble Mine Project* (2010) by Earl Becker of the Department of Fish and Game showed observations of heavy use by both black and brown bears of the areas around the Eagle Bay Creek crossing and the section of road between Pile Bay and Williamsport. PLP has neither properly surveyed nor evaluated the Northern Transportation Route for potential impacts to both black and brown bear, creating a significant deficiency in the data and information of FEIS.

The Becker report showed a strong behavioral response of brown bear to road traffic. The proposed traffic levels on the northern corridor road would exceed these levels, and there would be the potential for behavioral impacts resulting in the loss of these habitats. The potential impacts could be permanent, long term and include an even larger avoidance buffer around the road corridor. The FEIS conclusion that the overall impact from the road disturbance is not expected to be of a measurable extent is not supported by any recent data or other information in the FEIS. Without first having studied and determined where important use areas are in the project area, the extent to which they are available in the surrounding habitat and how the project would impact these habitats and bears, no such conclusion is justified. The ADF&G believes impacts to bears, and bear related recreation (hunting and viewing), could be significant, even given the limited information at hand. Despite acknowledging in the FEIS that the Project would have an effect on brown bears, there is no useful information describing the types of effects, or their extent, magnitude, and permanence. In addition, there is little discussion of how expected effects could be avoided, minimized, and/or mitigated.

c. Fish

In his comments on the FEIS, Reeves (2020)[8] makes three key points —

- The FEIS does not accurately represent the potential impacts of the elevated water temperatures. As a result, the assessment of potential effects of the proposed mine and the conclusions in the FEIS are invalid and most likely wrong.
- The analysis in the FEIS uses an inappropriate standard ("optimum temperatures" for a species) and fails to recognize the influence of local adaptation, which EPA (2014) noted was critical to considering in the mine assessment. Temperature standards used in the assessment are from populations throughout a species' distributional range, with very few citations from Alaska and fewer from western Alaska. The author of the report (Weber-Scannell 1991) from which the "optimal" temperatures were taken noted that there were critical limitations of applying these temperatures to fish in Alaska but the FEIS ignored this.
- The FEIS fails to recognize that: (1) small changes in water temperature can have significant ecological effects (e.g., time and size of fry at emergence); (2) there will be cascading effects of changes in the timing of life-history events (phenology); and (3) there will be cumulative effects as a result of the interaction of changes resulting from higher water temperatures with other environmental modifications, such as altered stream flows resulting from climate change.

Reeves also mentions that relatively small increases in water temperatures may have biologically significant impacts on Pacific salmon "… even when maximum water temperatures remain well below critical thresholds recognized by regulatory agencies (McCullough 1999)." The FEIS uses the "optimum" temperatures in Weber-Scannell (1991) as the standard for assessing the potential impacts of the mine despite their clear limitations and applicability and states that changes in summer water temperatures will be relatively small and remain with the "optimum range" reported by Weber-Scannell (1991), and as a result there will be no negative effect on salmon. This is clearly a false conclusion because of the application of inappropriate temperature standards.

Reeves further notes that the FEIS,

> … fails to recognize that: (1) small changes in water temperature can have significant ecological effects (e.g., time and size of fry at emergence); (2) there will be cascading effects of changes in the timing of life-history events (phenology); and (3) there will be cumulative effects as a result of the interaction of changes resulting from higher water temperatures with other environmental modifications, such as altered stream flows resulting from climate change. The analysis fails to recognize basic aspects of the ecology and biology of Pacific

[8] Gordon H. Reeves, PhD. Oregon State University, July 2020. Review of water temperature as discussed in PEIS, Chapter 5 Section 5.1.1.4 Water Temperature (unpublished). Dr. Reeves is an expert fishery biologist.

salmon, the limitations of the literature they used, cascading effects of potential temperature impacts at one life history stage on later stages, and that cumulative effects from other environmental changes are likely to have detrimental consequences to fish populations in the affected streams.

In summary, the conclusion of the FEIS that the "[t]he overall degree of impact is low: [e]xpected summer and winter water temperatures post release of treated surplus water would have a negligible or even positive effect on EFH quality (rearing Chinook, coho and sockeye salmon, and spawning Chinook, chum, coho and sockeye salmon), but infrequent dry and warm years could result in temporary or short-term effect; mortalities are unlikely" is false and not supported by any science or logic. The FEIS relies on an inappropriate standard ("optimum temperatures" for a species), ignoring the influence of local adaptation, which EPA (2014) noted was critical to consider. The FEIS further fails to recognize that: (1) small changes in water temperature can have significant ecological effects (e.g., time and size at emergence); (2) there will be cascading effects (cumulative effects) of changes in the timing of life-history events (phenology); and (3) the cumulative effects of the interaction of effects from increased water temperatures and other environmental changes (stream flow). As a result, the assessment of potential effects of the proposed mine and the conclusions in the FEIS are invalid, have a large degree of uncertainty, and are not supported by any sound scientific principles.

Finally, and significantly, the FEIS fails to explicitly discuss the importance of and adverse impacts to side channels of the rivers and streams that would be affected. These side channels are critical for salmon. Fishery biologists view the braided networks of side channels that are common in natural rivers in the Northwest and Alaska as evidence of a river's "complexity," which also includes deep pools, outcrops, and log jams, all of which provide important habitat for juvenile and adult fish. Generally, the more complexity a river displays, the better habitat it will provide for fish, because they can more easily find refuge and rearing habitat when they need it. Of all the factors that contribute to a river's complexity, fishery biologists have found that side channels and the number of junctions among them, and to a lesser extent woody material such as log jams, are most important to Chinook salmon. More complex rivers are generally slower than narrow rivers with impervious banks, so the juvenile salmon aren't swept downstream faster than they are ready to go. The more habitat complexity, the higher the productivity of Chinook salmon populations.[9] Side channels that incorporate a diversity of flowing- and standing-water areas are most likely to provide the variety of habitats (i.e., spawning, summer rearing, and overwintering) required by salmonids to complete their life cycle.[10] By not discussing the importance of side channels and the likely adverse effects of mine construction and operation upon side channels, the FEIS fails to account for and disclose the full

[9] Northwest Fisheries Science Center, NOAA, January 6, 2020; https://www.fisheries.noaa.gov/feature-story/restoring-side-channels-can-boost-salmon-recovery-puget-sound-rivers-new-research

[10] Rosenfeld, J.S., Raeburn, E., Carrier, P.C. and Johnson, R. North American Journal of Fisheries Management 28:1108–1119, 2008.

range of adverse impacts, rendering the conclusions regarding magnitude, extent, and significance of adverse impacts incomplete and defective.

5. Wetland Ecological Functions and Services

Sections 3.22.3.2 (Inference of Wetland and Other Waters Functions and Values) thru 3.22.7 (Wetland and Other Waters Functions and Values) claim that they address wetland functions and values. As with the DEIS, the information in these sections is of limited use, as explained below.

As mentioned in the FEIS narrative, the Hydrogeomorphic (HGM) classification was developed to provide a tool for measuring changes in the functions of wetland ecosystems due to impacts by proposed projects, and wetland restoration, creation, and/or enhancement. When used in combination with the Enhanced National Wetland Inventory (ENWI) classification system, the HGM type can give greater resolution to the ecological processes of wetlands with shared vegetation structure. While this may be true to a degree, it is not a substitute for collecting and providing specific information about ecological functions and services provided by identified wetlands and wetland systems. The FEIS narrative regarding classification of wetlands and functional assessments further identifies that,

> "[b]ecause an accepted methodology for wetland functional assessment is not available for this region of Alaska, a formal wetland functional assessment has not been completed; a functional assessment is not required for an EIS. In the absence of a formal assessment, wetland functions in the analysis area can be discussed qualitatively from the intersection of ENWI classification and HGM class." (FEIS 3.22.3.2)

Using this approach adopted by the Corps in the FEIS, wetland functions can only be discussed qualitatively in a general, very limited manner. Notably, this approach fails to provide an adequate level of detail for understanding the specific ecological functions and services provided by the identified wetlands and wetland systems. Moreover, this approach does not enable the permit reviewer or the public to understand the magnitude, extent, and significance of adverse impacts to those affected wetland resources. An environmental review premised on such an approach fails to take into consideration the full scope of adverse impacts to wetlands and wetland systems because it provides no insight into the ecological significance of the affected resources.

The FEIS sections referenced above (3.22.3.2 - 3.22.7) address the mine site and associated components specifically, but only offer information about vegetation, soils/geomorphology, topography, and hydrology. As with the DEIS, the FEIS then ascribes specific ecological functions described generally by the combination of ENWI and HGM to the various classes of wetlands in the study areas. Ascribing specific ecological functions by generic ENWI or HGM class is indefensible scientifically and a substantial misuse of both schemes.

As explained in my earlier report on the DEIS, ENWI is strictly a classification scheme. As originally developed, NWI was based on dominant plant community type (*e.g.*, trees) and major land feature (*e.g.*, lake or river). ENWI now includes some aspects of hydrology and landscape position, but it was not designed, and should not be used, to attribute specific ecological functions to specific wetlands.

HGM is a two-part scheme: classification and functional assessment methodology. Wetlands are first classified by geohydrology and landscape position, then, depending upon class and subclass and modifiers, metrics and formulas are developed to assess specific functions. When properly developed and applied, the functional assessment part of HGM yields numeric results. The classification part of HGM can be useful for describing and differentiating between major wetland types across a landscape. In a generic sense, HGM classification can inform about broad-based ecological functions, but without developing the associated functional assessment methods, including metrics and formulas, it does not and should not be used to ascribe specific ecological functions to specific wetlands. As a result of the misuse of the ENWI and HGM approaches, the FEIS is devoid of any meaningful discussion about the specific ecological functions for the wetlands that would be adversely affected by the mine and its associated components. For example, these sections of the FEIS do not address specific ecological functions such as nutrient production and export (aka food chain support), which is critical for salmon production, or wildlife habitat, e.g., which specific amphibian species and wetland-dependent mammals use the areas for the proposed mine, TSF area, or other components.

Also, the FEIS does not describe the level at which potentially affected wetlands are currently performing each function. Consequently, the FEIS does not characterize how performance of each function would change as a result of the direct, indirect (secondary), and cumulative adverse effects of the construction and operation of the mine and its components. This information is important to determine the nature and degree of adverse effect that the proposed project would have on the structure and function of the wetlands and wetland systems. As such, the FEIS is devoid of any real analysis regarding the project's impacts to wetlands and other aquatic resources and the critical ecological systems that they support, particularly the various wildlife habitats that are present.

6. "Regionally Important" Wetlands[11]

In an expansive area that is mostly roadless and undisturbed by human activities, *all* the wetlands are vitally important because of the ecological functions and services they provide, e.g., support of the world-class salmon fishery. The FEIS arbitrarily attempts to minimize the importance of wetlands in the project area by creating and relying on a category of "regionally important" wetlands in its analysis of impacts. This arbitrarily created category is scientifically unjustifiable,

[11] This is not a term relevant to analysis under or compliance with NEPA or the Section 404(b)(1) Guidelines, and it is unclear how and why PLP and the Corps are making this determination. As used for the FEIS, it is groundless and useless.

indefensible under any construct, and meaningless given the Corps' and FEIS's failure to actually assess impacts to wetlands with a site-specific formal functional assessment.

The FEIS (Section 3.22.5) describes "regionally important" wetlands as those that —

- provide habitat for sensitive or regionally important fish, wildlife, birds, or plant species;
- are scarce, or rare and high quality, in a given region;
- are undisturbed and difficult or impossible to replace;
- are valued by Alaska Natives for their subsistence value; and,
- are culturally important plants.

The FEIS arbitrarily gives far greater weight to losses of aquatic resources that it identifies as being "regionally important" as compared to aquatic resources that the FEIS asserts do not meet this definition. Conveniently, the FEIS's list of regionally important wetlands *omits the wetland types that are estimated to sustain the greatest level of project-caused impacts* (i.e., shrub and herbaceous wetlands). Even if one accepted the fabricated concept of regionally important wetlands, nearly all of the wetlands in the analysis area for the mine and associated components appear to meet the criteria listed above. In addition, the criteria for "regionally important wetlands" do not account for the full ecological functions provided by these resources and result in understating the extent and significance of adverse impacts to the affected aquatic resources.

Section 3.22.6 of the FEIS mentions that,

> … baseline mapping of streams did not explicitly identify riffle and pool complexes in the analysis area, with the exception of the North Fork Koktuli (NFK) and South Fork Koktuli (SFK) rivers, and Upper Talarik Creek (UTC) near the mine site (R2 et al. 2011a). Habitat typing discussed in Section 3.24, Fish Values, shows that the mainstem NFK below the mine site is dominated by riffle habitat with few mainstem pools. Upstream of the mine site, the NFK contains equal proportions of riffle and run/glide habitats, with increasing frequency of beaver-formed pools. The upper 10 miles of the NFK flow through a region with small, shallow ponds (i.e., less than 3 acres), dominated by Big Wiggly Lake. The upper SFK, just below the mine site, is also dominated by riffle habitat with few pools. UTC below the mine site is equally dominated by riffle habitat and run/glide habitat, with few pools.

As an indication of the unscientific and wholly inadequate analysis, the FEIS does not identify streams, including riffle and pool features, as "regionally important."[12] Also, the FEIS does not quantify and include off-channel habitats, even though off-channel habitats can be an extremely important factor in salmonid distribution. Moreover, the FEIS does not explain how the criteria mentioned above were actually applied to identify resources that it alleges are more important than others. This omission and lack of supporting explanation underscores the arbitrary concept of "regionally important" in the FEIS and renders its analysis of wetlands meaningless and worthless.

7. Direct and Indirect Adverse Impacts

In Section 4.22.1 (EIS Analysis Area) and 4.22.2, (Analysis Methodology), the FEIS explains that potential direct and indirect effects to wetlands and other waters were assessed according to several factors. Much of the FEIS discussion for these topics is seriously flawed, as explained below.

a. Analysis Methodology

The FEIS at 4.22.2 explains that,

> … [p]otential direct and indirect effects to wetlands and other waters were assessed according to four factors: the magnitude (or intensity of the impacts); the duration (how long the impact would last); the extent (the area of the impact); and the likelihood of the effect (the certainty that the impact would occur, should the project be permitted).

This section of the FEIS further explains that,

> … [t]he severity of impacts is summarized by the relative abundance of the resource, perceived value of the resource, and sensitivity of the resource to the impact, as appropriate. The relative abundance of a resource is evaluated as the percent of the total wetland and/or other water area, estimated from the National Wetland Inventory (NWI) at the hydrologic unit code (HUC) 10 watershed scale. The perceived value of the resource is summarized by type of special aquatic site or regionally important wetland as defined in Section 3.22, Wetlands and Other Waters/Special Aquatic Sites. The sensitivity of the resource is presented for fragmentation and dewatering and is evaluated by hydrogeomorphic (HGM) class.

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[12] In the summer during critical low flows and high temperatures, deep holding pools provide cool upwelling oxygenated water, cover, and feeding areas for juveniles and resting places for salmon.

- Upwelling pressure from groundwater and deep pools enhance the flows through the stream-bed gravel, where wild salmon spawn, increasing the survival of eggs and emerging fry.
- Deep pool habitat functions at low summer flow conditions to support fish passage for adult and juvenile salmon.
- Riffle and deep pool complexes support nutrient distribution with salmon carcass, plus restoring side channel holding and rearing areas for juvenile fish,

See http://www.instreamconservation.org/why-we-need-deep-pool-holding-habitat-in-our-nw-rivers/.

This is flatly wrong and renders the FEIS analysis of impacts to wetlands and other waters fundamentally flawed. Chiefly, the significance of impacts to wetlands depends upon the specific ecological functions and services provided by the wetlands, the extent of impacts to those wetlands, and the type (direct or indirect) and permanence of those impacts. Perceived value and regional importance are wholly subjective and meaningless criteria. In limited circumstances, relative abundance may increase the significance of impacts, *e.g.*, for rare types of resources, but it never decreases the importance of a wetland resource type or the significance of impacts to that wetland resource. In addition, sensitivity of a wetland or water resource is a valid consideration, but it is unrelated to fragmentation and dewatering (those are simply categories of direct or indirect impacts). Sensitivity depends heavily on type of wetland, the specific ecological functions and services provided by that wetland, the type of impact (direct or indirect), and the permanence of the impact. This explanation of sensitivity contained in the FEIS is not based on any objective standards or science.

Section 4.22.1 (and section 3.22.2 - Analysis Area) explains that the area of analysis for the mine site includes "the direct disturbance footprint; areas of indirect disturbance due to habitat fragmentation of wetlands and other waters (Figure 4.22-1); a 330-foot zone around the direct disturbance footprint to account for the impacts of fugitive dust deposition …;" 330 feet along the Transportation Corridor and around ports to account for the indirect impacts of fugitive dust deposition; and 150 feet for the natural gas pipeline through overland areas. With respect to the 330 feet "standard," on page 4.22-8, the FEIS states that,

> [b]ecause the physical and chemical effects of dust deposition have been shown difficult to document beyond 330 feet from the disturbing action (Walker and Everett 1987), an indirect impact area was calculated by buffering the area of direct disturbance by 330 feet, and then subtracting the direct disturbance footprint to exclude wetlands and other waters directly impacted by permanent facilities.

Simply because it may be difficult to document an effect beyond 330 feet does not equate to "no disturbance." The FEIS provides no actual scientific justification for limiting the analysis to this distance or the others listed. In addition, studies have shown that while dust load decreases with distance, it can be noticeable up to and likely beyond 600 m to 1,000 m (0.3 to 0.6 miles) (Walker and Everett 1987, Myers-Smith *et al.* 2006).

On page 4.22-5, the FEIS states that "[i]mpacts to wetlands, open freshwaters, estuarine waters, marine waters, rivers, streams, and other waters are assessed here from a National Environmental Policy Act (NEPA) perspective, which would differ from how they are treated under the Clean Water Act (CWA) Section 404(b)(1) guidelines" (emphasis added). The FEIS does not provide an explanation for this assertion, which is plainly incorrect. Regarding impacts to wetlands and other waters, there is a difference in terminology (indirect v. secondary), but little substantive difference. Whether under the Clean Water Act or NEPA, the Corps cannot rely on such arbitrary

standards or definitions to identify and describe the extent or the range of impacts to wetlands and other waters.

b. Magnitude of Impact

For magnitude of impacts to wetlands and other waters the FEIS explains that,

> "… [b]ecause the magnitude of impacts to wetlands, and other waters is dependent not only on the resource type, but also the relative abundance and location of that resource in a watershed, the magnitude of impact is also evaluated at the watershed level as a percent of the total watershed area … Magnitude of impact also relates to the perceived importance of the resource …" (section 4.22.2).

For several reasons, this analysis of impacted wetlands is substantially flawed and drastically deficient.

Notably, the FEIS does not explain how or why it asserts that the location of a particular wetland affects the magnitude of an impact to that wetland. There is no scientific basis for such an assertion. The relative abundance, location, and perceived importance of a particular wetland resource have nothing or little to do with magnitude of impact. In addition, "perceived importance" is a completely subjective criterion made out of whole cloth by PLP and the Corps. Again, the key factors regarding magnitude are the specific ecological functions and services provided by the wetlands, the extent of impacts to those wetlands, and the type and permanence of those impacts. For example, a large direct temporary impact to a wetland resource that provides few and/or low levels of ecological functions may not be concerning, while a smaller indirect permanent impact to a wetland resource that provides high levels of ecological functions may be significant. As explained above, without information regarding specific ecological functions and services provided by the potentially affected wetland, the extent (area) of those impacts, and the type and permanence of those impacts, no actual determinations can be rendered regarding the significance of the potential impacts to the wetlands. The lack of such specific information in the FEIS is another of its major failures.

In many places in the FEIS, the Corps resorts to a scientifically unsupported argument based on percentages of wetlands impacted as compared to the Bristol Bay watershed. For example, Table 4.22-2 lists the area of direct impacts to Special Aquatic Sites and Regionally Important Wetlands as .011 percent of the total area of the watershed for Amakdedori Creek-Frontal Kamishak Bay, Gibraltar Lake, Koktuli River, Iliamna Lake, Newhalen River, and Upper Talarik Creek. Leaving aside the baseless concept of "regionally important wetlands" described above, the percentage impacted approach drastically misleads the reviewer and the public by implying that the adverse impacts are insignificant. As mentioned in its Proposed Determination of July 2014, EPA pointed out that,

> This perspective is flawed because it assumes that these habitats are less ecologically valuable than streams, wetlands, and other aquatic habitats elsewhere in the watershed and ignores the important role that individual streams or stream reaches, wetlands, lakes, ponds, and other aquatic habitats can play in protecting the genetic diversity of Bristol Bay's salmon populations [and other fish and wildlife]. In the Bristol Bay region, hydrologically diverse riverine and wetland landscapes provide a variety of salmon spawning and rearing habitats. Environmental conditions can differ among habitats in close proximity, and recent research has highlighted the potential for local adaptations and fine-scale population structuring in the Bristol Bay and neighboring watersheds (Quinn *et al.* 2001, Olsen *et al.* 2003, Ramstad *et al.* 2010, Quinn *et al.* 2012). Losses that eliminate local, unique populations would erode the genetic diversity that is crucial to the stability of the overall Bristol Bay salmon fisheries (Hilborn *et al.* 2003, Schindler *et al.* 2010, EPA 2014a: Appendix A, EPA 2014b).

The Proposed Determination also pointed out that,

> PLP's approach is also problematic because it is inconsistent with USACE guidance in effect since 1989. In this 1989 guidance, USACE Headquarters specifically criticizes New Orleans District USACE's assertion that wetland losses associated with a project under review were "inconsequential" because "… project alterations of wetlands represents a very small portion of similar habitat within the project vicinity and coastal Louisiana…only 2.39% of the saline marsh on Grand Isle and only 0.005% of the saline marsh in coastal Louisiana …" The 1989 guidance finds that this approach ignores the fact that the cumulative effects of many projects could add up to very significant wetlands loss and notes that the proposed destruction of 22 acres of special aquatic sites in the case under review by New Orleans District could not simply be "dismissed as unimportant" (USACE 1989).

The approach to assessing the magnitude of impacts in the FEIS is stunningly inadequate.

c. Indirect Impacts

The FEIS inappropriately constrains the analysis of indirect adverse impacts to fragmentation of aquatic resources, fugitive dust deposition, downstream habitat degradation, and dewatering. FEIS at 4.22.3. There is no explanation for why the FEIS analyzes *only* these four types of indirect impacts to wetlands and other aquatic resources. As I discussed in my report on the DEIS, indirect impacts to wetlands and other aquatic resources also include,

- disruption of surface and ground water hydrologic regimes;
- fragmented aquatic resources include wetlands and other waters upgradient of the construction footprint of the work that—due to the direct impact (i.e., from discharges of

dredged or fill material into waters of the US[13])— would be hydrologically disconnected from previously connected aquatic resources;
- conversion of one wetland type to another;
- water quality degradation downstream of the mine site;
- erosion and sedimentation effects downstream and upstream of disturbances to stream channels;
- increased temperature, noise levels, and light in adjacent cleared/disturbed wetlands; and,
- increased damage from winds/storms along the edges of remaining wetlands from clearing/ disturbance.

The FEIS fails to fully address all of these fairly typical indirect impacts. The FEIS addresses a couple of these indirect impacts but only very generally and does not provide a meaningful discussion of the extent, permanence, and significance of these indirect impacts. Although the potential reduction of function attributed to these wetlands and other waters is summarized by HGM class, there is little to no analysis of the specific ecological functions and services that would be lost and degraded—a critical component for evaluating impacts to wetlands.

In addition, the FEIS attempts to explain away reasonably foreseeable impacts to wetlands by incorrectly defining fragmentation:

> [f]ragmented aquatic resources include wetlands and other waters upgradient of the construction footprint of the work that … would be hydrologically disconnected from previously connected aquatic resources …

and

> … wetlands and other waters occurring hydrologically upgradient of the placement of fill or seepage collection and recycle ponds were manually attributed as fragmented in GIS. Aquatic resources for which hydrology would be maintained through diversion channels, sediment ponds, and/or culverts were not considered fragmented. … Fragmentation would be expected exclusively at the mine site, because hydrologic connectivity of wetlands and other waters would be maintained by bridges and culverts in other project components (Figure 4.22-2). (FEIS 4.22-6.)

The FEIS gets this completely wrong. Fragmentation of wetlands from a construction footprint occurs down-gradient as well. Fish and wildlife move in both directions, especially those that tend to travel along waterways and via adjacent wetland habitat. Wetlands and other aquatic resources that are separated by culverts can indeed be (and often are) fragmented in an ecological sense. The FEIS's conclusions premised on such a general, incorrect assertion is bad science. There is no ecological reason to support these statements.

[13] See the recently issued "Navigable Waters Protection Rule," April 2020, https://www.epa.gov/sites/production/files/2020-01/documents/navigable_waters_protection_rule_prepbulication.pdf

d. Temporary versus Permanent Impacts

The manner in which the FEIS distinguishes between temporary and permanent adverse impacts is overly broad and inappropriate. In the FEIS (4.22.2), impacts are assessed in terms of duration,

> … because some wetlands or other waters would be partially or fully reclaimed concurrent with or after the construction phase, and others would not. The duration of impacts would be considered temporary when wetland or aquatic functions would be reduced during the construction phase only, with pre-construction function restored by the end of construction.[14]

This "definition" presents several problems. It mentions that some wetlands would only be partially reclaimed. The FEIS neither addresses the issue of partial reclamation nor describes which adverse impacts would only be partially reclaimed. The FEIS doesn't identify or describe the impacts that are non-reclaimable, i.e., they would be permanent. As a result, those permanent impacts should be included in the sections on permanent impacts.

With respect to adverse impacts, the FEIS contains a number of unsupported and false statements with respect to adverse impacts. For example, the FEIS states, "[t]he area of indirect impact due to dewatering is defined as the zone expected to experience a drawdown of groundwater greater than 3 feet as predicted by groundwater modeling." FEIS at 4.22-11. This statement is flat wrong. According to the Army Corps Wetland Delineation Manual (1987) and Manual Supplement (2012), the definition of wetland hydrology is "… 14 or more consecutive days of flooding, ponding, *and/or a water table 12 inches or less below the soil surface*, …" (emphasis added). For the purpose of analyzing indirect impacts due to dewatering, the Corps should be including all wetland areas where the drawdown is predicted to exceed 12 inches and the length of time that drawdown will persist. The FEIS also states that, "[w]etlands and other waters for which the water level remained at or within 3 feet of the surface after the drawdown were not considered impacted, and removed from the selection." FEIS at 4.22-11. Clearly, the analysis of the indirect impacts of dewatering to wetlands are vastly underestimated.

The FEIS also states that, "[b]y definition, wetlands are dominated by obligate wetland plant species with limited tolerance for drought." FEIS at 4.22-1. This is an absurd statement. Wetland indicator categories have nothing to do with how wet a wetland may be or the tolerance of a particular plant species or indicator category to drought. By definition, wetlands are dominated by plant species that are categorized as Facultative, Facultative Wetland, and/or Obligate. The categories indicate the frequency of occurrence in wetlands for a particular species (i.e., how likely a particular species can be expected to be growing in a wetland).

[14] This implies that ecological functions disturbed and degraded, or even lost during construction would magically return when construction ceased. This is both unrealistic and absurd. Damaged and degraded ecological functions can take months if not years to recover, and in some cases may never recover fully. The FEIS neglects to acknowledge or address this point.

The FEIS distinction between adverse impacts that would be temporary or permanent has no basis in science, is illogical, and provides the reviewer with no meaningful explanation to understand the duration of adverse impacts.

8. The Northern Transportation Corridor

Recently (April 2020), PLP revised the proposed project description, changing the transportation corridor from south to north. The revised description includes an 82-mile transportation corridor from the mine site to a year-round port site located at Diamond Point in Iliamna Bay on Cook Inlet consisting of:

- a private two-lane unpaved road that connects to the existing Iliamna/Newhalen road system; and,
- a buried concentrate pipeline to transport copper-gold concentrate from the mine site to the port and a return water pipeline to the mine site.

The revised route would include at least 17 bridges and 112 culverts. It should be noted that the proximity of a large segment of the "northern route" to the lakeshore, as well as the nature of the mountainous terrain and stream drainages traversed in this corridor, make the scope of impacts for this route substantially different from any effects that were described in the DEIS or FEIS. It also should be noted that because of the terrain, the northern route presents increased risk of accidents and spills and that spills would likely deliver water and pollutants rapidly and relatively directly to Iliamna Lake. These factors likely make adverse impacts to wetlands and streams that would result from the northern route more significant. For example, due to the increased number of culverts, fragmentation impacts to streams (and fish and other aquatic life) would be more widespread and significant than for the southern route.

As mentioned above, portions of the corridor are known to be used heavily by brown and black bear, especially along streams. The FEIS conclusion that the overall impact from the road disturbance is not expected to be of a measurable extent is not supported by any recent data or other information in the FEIS. Without first having studied and determined where important use areas are in the project area, the extent to which they are available in the surrounding habitat and how the project would impact these habitats and bears, no such conclusion is justified.

The change to the Northern Transportation Corridor is a significant alteration to the proposed project. Astonishingly, adverse impacts, e.g., to fish and wildlife habitat connectivity and water quality and quantity, from the new northern route are mostly unaddressed in the FEIS.

9. Cumulative Effects of Loss of Wetlands, Lakes, and Ponds

The FEIS fails to adequately consider the cumulative effects of loss and degradation to wetlands, lakes, and ponds because it fails to address reasonably foreseeable mining expansion and its

impacts. It is reasonably foreseeable that the Pebble Project will expand beyond its initial 20-year proposal. It is also reasonably foreseeable that the Pebble Project results in additional mining developments in the Bristol Bay and Cook Inlet watersheds. As a result, *it is reasonably foreseeable that tens of thousands of acres of additional adverse impacts to wetlands and other waters could occur.* However, the FEIS lacks any such analysis.

According to Table 4.22-38 of the FEIS, an expansion of the preferred alternative (the 78-year mine) with the Northern Transportation Corridor would impact at least a total of 15,198 acres of wetlands and waters, and at least a total of 548 miles of streams. As explained in previous sections of this report, the affected wetland acreages and stream miles listed in the FEIS are almost certainly considerably underestimated.

Table 4.1-1 in the FEIS, Potential Reasonably Foreseeable Future Actions (RFFAs) Evaluated for Cumulative Effects, lists a variety of mines that are targeted for exploration (especially if the Pebble Mine is authorized and constructed) within the Bristol Bay and Cook Inlet watersheds. Among those RFFAs are:

- Pebble South, a 54-mile^2 porphyry copper deposit/claim ~9 miles southwest of Pebble deposit. Prospect is part of the PLP/Northern Dynasty Minerals (NDM) Limited (Ltd.) claim block.
- Big Chunk South, a 73-mile^2 porphyry copper deposit/claim ~12 miles north of the Pebble project area. The claim block is entirely in the Chulitna River drainage, which flows into Lake Clark National Park and Preserve.
- Big Chunk North, a porphyry copper deposit ~21 miles northwest of the Pebble project area. The claim block straddles the drainage divide between the Nushagak and Kvichak River watersheds.
- Fog Lake Gold, copper in volcanic rocks located ~46 miles southeast of the Pebble Project and south of Iliamna Lake, and roughly 10 miles north of the transportation corridor to Amakdedori port.
- Groundhog, a 196 mile^2 porphyry copper claim ~3 miles east from the Pebble project area.
- Shotgun, Quartz-feldspar porphyry deposit with gold as the primary interest, located roughly 99 miles northwest of the Pebble Project, 90% owned by TNR Gold Corporation. If developed, Shotgun could access tide water via barge transport from Dillingham (93 miles away) up the Nushagak River to Koliganek, New Stuyahok, or Ekwok (49, 68, and 74 miles away, respectively).
- Johnson Tract, a gold-rich polymetallic deposit located roughly 80 miles east of the Pebble Project, owned by Cook Inlet Region, Incorporation (CIRI) and subject to an exploration agreement with Constantine Metals Resources Ltd. CIRI has access rights through Lake Clark National Park and Preserve to a port site at Tuxedni Bay on Cook Inlet.

In addition to those mines, listed as RFFAs are several other major projects involving oil and gas exploration, transportation and infrastructure, and energy and utilities. Figure 4.1-1 describes the locations of these RFFAs in relation to the Pebble Mine.

Figure 13-2 in the BBA illustrates how cumulative and induced effects could follow the initiation of large-scale mining in the Nushagak and Kvichak River watersheds. The original mine—with its associated transportation corridor, port, power generation facilities, and other infrastructure—would likely initiate the accumulation of impacts across the watersheds. Mineralized areas in the region as listed above are currently without development infrastructure (*e.g.*, roads, utilities, and airports), which creates an expensive barrier to development. Thus, it is reasonably foreseeable that infrastructure development for an initial mine could make mining more cost-effective for other, smaller mineral deposits, facilitating further accumulation of adverse impacts to wetlands and other waters. In addition, the initial and subsequent mines would increase accessibility of the region, causing other induced development and associated impacts.

The evaluation of cumulative impacts in the FEIS presents impacts in the most general of terms, with no quantitative or qualitative evaluation of additional impacts resulting from each scenario. The FEIS does not attempt to estimate the magnitude, duration, or extent of these impacts, especially with respect to dewatering of wetlands and other waters. A proper analysis of cumulative adverse impacts would address the presence and approximate extent of wetlands and other waters for each of the RFFAs; describe the ecological functions of those aquatic resources (as specifically as possible) and how those functions would likely be impacted by the activities associated with the proposed mine (e.g., dewatering, spills, etc.); and the expected duration of impacts.

To date, the Bristol Bay watershed has experienced minimal cumulative stresses associated with human activity, and their ecosystems are relatively undisturbed by human development. If the Pebble Mine were authorized, the combined adverse impacts over time to wetlands and other waters from the Mine and the RFFAs listed above would likely result in tens of thousands of acres of additional adverse impacts to wetlands and other waters. Unprecedented and uncompensable, adverse impacts of this scope, scale, and degree would significantly and irreversibly damage the exceptional ecological value of the fisheries and wildlife resources in the Bristol Bay watershed.

10. Compensatory Mitigation Plan

In Section 5.3.2, the FEIS contains a vague description of proposed compensatory mitigation measures. These measures bear no ecological relationship to the magnitude, extent, or significance of the anticipated loss and degradation of the ecological functions and ecosystem services of the affected wetlands and other aquatic resources. Yocom, 2020,[15] summarizes the failures of PLP's Plan —

[15] Yocom, Thomas G. 2020. The Pebble Project Draft Compensatory Mitigation Plan (January 2020) provides no habitat replacement or preservation to offset thousands of acres of wetland and aquatic habitats that the Pebble Mine Project would destroy, degrade, or fragment. A Report Prepared for Earthworks. Unpublished.

Whereas the regulations call for those projects affecting plant and animal populations to achieve post-project ecological conditions that are higher than pre-project, PLP's plan, as proposed, results in a 100% net loss of wetland and aquatic acreage and functions.

Perhaps of even greater concern, there is little reason to expect that the applicant's project is a single-and-complete project as proposed. It is far too small to practicably exploit the mineral resources of the Pebble deposit or justify the extensive infrastructure that will be required, including a port, a pipeline across Cook Inlet, and an 80+ mile access road. And there is even less reason to accept PLP's claim that it would fill the mine pit with pyritic tailings and close it after 20 years of active mining, leaving the vast majority of the ore—ore that it has spent years delineating—unmined. There is no mining operation in history that has simply shut down and walked away for no good reason after only exploiting less than 10% of a known deposit,[16] particularly a deposit it has spent hundreds of millions of dollars over nearly two decades to delineate, develop, and lobby for.

> Instead, it is far more than "reasonably foreseeable" that larger additional phases of development are inevitable,[17] and are, in fact, contemplated by the applicant.[18] As such, the realistically anticipated project impacts … would dwarf those described in the FEIS, and the compensatory mitigation that should be required under the regulations would be extraordinarily large.
>
> Even if the size of the proposed project and its planned closure were legitimate, a failure by the Corps to require that the applicant fully offset its 20-year proposed project impacts would result in unprecedented net losses of wetland and aquatic habitats beyond those of any copper mine ever proposed in the United States.

and,

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[16] According to PLP's June 2020 Project Description, the 20-year mine would extract 9% of the copper, 11.4% of the gold, and 7.1 percent of the molybdenum in the Pebble Deposit. The amount of copper that would be extracted dwarfs the quantities of copper and molybdenum that would be extracted. See page 13 of the revised project description.

[17] Borden, R.K. 2019. Pebble Mine Project Economics. Letter from Richard K. Borden to Shane McCoy, USACE, Alaska District. May 28, 2019. 7 pages.

[18] Northern Dynasty Mines President Ron Thiessen's presentation on Jan 22, 2018 at the Vancouver Resource Investment Conference: "*Well, I don't know too many mines that start off at a scale and don't change over time. I mean, one of the things is, you know, today I can't stand up here and tell you after 20 years what will be the next mining method. Will it be open pit, will it be underground, will we want to expand the concentrator, will we want to put a gold circuit in. So, why would we attempt to permit something like that today when we couldn't answer the questions that the Army Corps of Engineers would be asking us about that. If we want to do those things, then we will have to permit those as and when we decide how we're going to go about it. So, it's only natural we permit what we see in the foreseeable future as an operation. At 160,000 tons a day, the resource that we have actually could last for 200 years.*" (emphases added. See: https://www.youtube.com/watch?v=pBs1dnP_9eo)

> Whereas PLP has, yet again, put forward a woefully inadequate compensatory mitigation proposal, the real problem here lies with the Alaska District of the Army Corps of Engineers. The Corps has done nothing to date to compel PLP to provide any meaningful offsets to what is likely the single most environmentally damaging proposal ever considered under the 404(b)(1) Guidelines. The Corps should long ago have rejected PLP's compensatory mitigation plans. In the author's view, the Corps has shown blatant disregard for compliance with Clean Water Act regulatory compliance and the national goal of no net loss of wetland and aquatic areas.

As presently proposed, the project fails to comply with 40 CFR 230.10(d), and the lack of appropriate mitigation measures underscores that the project would cause or contribute to significant degradation of the aquatic ecosystem (40 CFR 230.10(c)).

11. Conclusions

Over the course of my professional career, I have reviewed more than 40 Environmental Impact Statements for Clean Water Act (CWA) permits under Section 404, and more than 200 Environmental Assessments and Statements of Findings by the Army Corps of Engineers for CWA permits under Section 404. In terms of disclosing and fully describing the wetland and other aquatic resources that could be adversely affected by a proposed project, including the full range of direct, indirect, and cumulative adverse impacts to those resources, this FEIS is easily the poorest quality and most deficient document I have ever reviewed.

The FEIS is markedly deficient in several respects. The FEIS—

- fails to provide current and reliable data regarding the presence and distribution wildlife; consequently these data are seriously outdated and undependable;
- fails to provide substantive, accurate, and detailed information regarding the existence, extent and ecological functions of wetlands and other waters that would be destroyed or degraded by the Pebble Project. The extent of wetlands is decidedly underestimated;
- fails to provide substantive, accurate, and detailed information necessary to clearly and fully describe the extent, magnitude, and permanence of direct and indirect adverse impacts to wetlands and other water resources that would be caused by the mine and its associated components;
- fails to describe, quantify or qualify temporary indirect adverse impacts to wetlands or other water resources; and,
- fails to propose a compensatory mitigation plan that bears any ecological relationship to the loss the degradation of ecological functions and ecosystem services that would be lost and degraded by the Pebble Project.

Consequently, the FEIS vastly underestimates of the extent, magnitude, and permanence of the direct and indirect adverse effects to wetlands and water resources that would occur from the Pebble Project.

Notwithstanding revisions to and additional information included in the FEIS, the project would still cause devastating adverse impacts to wetlands and other water resources at the mine site and its associated components. Even accepting the flawed numbers of impacted wetlands and streams provided in the FEIS, the Pebble Project would have an immense, unprecedented, and crippling impact on the ecology of the Bristol Bay watershed.

The revised information in the FEIS does not alter my opinion in my previous report on the DEIS: were this project to receive a Clean Water Act section 404 permit from the Army Corps of Engineers, it would be among the largest, and likely the most damaging project ever authorized under the Clean Water Act. The proposed project does not comply with the Section 404 (b)(1) Guidelines (40 CFR 230.10 (a)-(d)) because, among other things, it would cause or contribute to significant degradation of the waters of the U.S.

The proposed project cannot be permitted under Section 404 of the CWA for two principal reasons.

- There does not exist sufficient information to make a reasonable judgment as to whether the proposed discharges can comply with the Section 404(b)(1) Guidelines (40 CFR Part 230.10 (a)-(d)). See 40 CFR Part 230.12(a)(3)(iv). Throughout this report, I highlighted that paucity of sufficient information.
- Notwithstanding that information deficit, based on the available information I reviewed, the project would clearly cause or contribute to significant degradation of the affected aquatic resources, in violation of Section 230.10(c) of the Guidelines.